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SOCIETY OF RHEOLOGY MEETS AT BUREAU

The Society of Rheology held its annual meeting at the Bureau on October 13 and 14, the program having been arranged by J. W. McBurney, of the Clay and Silicate Products Division. The members were welcomed by the Director, Lyman J. Briggs, after which the first session was devoted to a symposium on rheology in science and industry. The subject was introduced by A. S. Hunter, E. I. du Pont de Nemours & Co., Inc. The following papers were presented: Rubber, J. H. Dillon, Firestone Tire and Rubber Co.; Paint and varnish, G. G. Sward, Institute of Paint and Varnish Research; Glass, G. W. Morey, Geophysical Laboratory; Geophysics, L. H. Adams, Director, Geophysical Laboratory; Soil mechanics, C. A. Hogentogler and L. A. Palmer, Public Roads Administration; Clay products and masonry, J. W. McBurney, National Bureau of Standards; Plastics and organic fibres, G. M. Kline, National Bureau of Standards; Dental materials, National Bureau of Standards; Concrete, W. H. Herschel, National Bureau of Standards; Medicine and biology, F. S. Brackett, National Institute of Health; Metals, A. Nadai, Westinghouse Electric and Manufacturing Co.

Luncheon was served in the Bureau's cafeteria. The afternoon was given over to inspection trips of nearby laboratories, including those of the National Bureau of Standards, where the apparatus for determining the absolute viscosity of water was of special interest.

The annual dinner, at Wardman Park Hotel, was attended by members and guests, including the guest speaker, Paul R. Heyl, chief of the Bureau's Sound Section, whose subject was Seventeenth and Eighteenth Century Science from the Archives of the Royal Society. Doctor Heyl reminded his audience that many of the basic problems of science still await solution, so that, after all, the attitude of the re-

[1] Published with the approval of the Director of the Budget.

search worker today should not be so different from that of his predecessor 150 or 200 years ago.

At the meeting on the morning of October 14 five papers were read: A three-dimensional model to demonstrate the relationship between principal strains and simple shears, M. Mooney, U. S. Rubber Co., Passaic, N. J.; Note on the use of the rolling-ball viscometer for measuring the effect of pressure upon the viscosity of liquids, R. B. Block, Wright Field, Dayton, Ohio; Computation of some physical properties of lubricating oils at high pressures, R. B. Dow, Pennsylvania State College, State College, Pa.; Neglected fields of rheology, E. C. Bingham, Lafayette College, Easton, Pa.; and Psycho-rheology, Scott Blair and F. M V. Coppen, National Institute for Research in Dairying, University of Reading, Reading, England.

The meeting closed with a business session at which the officers were elected for the coming year: President A. S. Hunter, E. I. du Pont de Nemours and Co., Inc.; First Vice President, J H. Dillon, Firestone Tire and Rubber Co.; Second Vice President, R. H Ewell, Purdue University; Secretary-Treasurer, H. R. Lillie, Corning Glass Works; Editor W. P. Davey, Pennsylvania State College; Associate Editor H. F. Wakefield, Bakelite Corporation.

SOLUBILITY OF GLASS USED FOR MAKING BOTTLES

Comparison of the results of studies made by different laboratories on the determination of the solubility of glass used for making bottles and similar containers led to the conclusion that some of the inconsistencies found might be attributed to the methods used for titrating the "soluble alkali."

A study of the methods recommended or in current use was made by Donald Hubbard, Edgar H. Hamilton, and Alfred N. Finn, who conclude that, all other conditions being equal, the method of titrating should be changed.

In this investigation the aqueous "extracts" of bottles were titrated with fiftieth normal acid, using the following indicators: Phenolphthalein, phenol red, brom thymol blue, methyl red, chlor phenal red, paranitro phenol, and methyl orange. At the same time that these titrations were being made, the "extracts" were also titrated potentiometrically, using the glass electrode as the indicator. It was found that the disturbing effect of carbon dioxide absorbed by the "extracts" during their preparation and titration was great enough to vitiate results, especially when the amount of dissolved alkali was small.

Since the potentiometric titrations indicated that the effect of carbon dioxide should be eliminated, a series of "extracts" were acidified with a known amount of sulfuric acid, heated, boiled under reduced pressure, and "back titrated" with fiftieth normal alkali, both colorimetrically and potentiometrically, using the same indicators as in the "direct" titrations first used.

The results in "direct titration" varied from the true value of 5.50 ml by −2.7 ml for phenolphthalein to +0.2 ml for methyl orange, while in the "back" titration the greatest differences found were −0.7 ml for methyl orange and +0.15 ml for phenolphthalein. All other indicators used gave results which varied less than 0.15 ml from the true value.

It seems, then, that unless methyl orange is used as the indicator, or the effect of carbon dioxide can be otherwise eliminated, acidification of the extract and "back" titration are to be recommended for determining the amount of alkali dissolved from glass by water.

RELATIVE WEAR RESISTANCE OF CONCRETE FLOORS

A portable apparatus for producing rapid wear of concrete floors, and an optical device for measuring the depths of wear, have been designed and built by Louis Schuman and John Tucker, Jr. The apparatus, which is described in the Journal of Research for November (RP1252), consists essentially of three rotating steel disks moving in a circular path on the test surface.

Methods of testing have been developed for measuring the wear resistance to depths of about 0.1 inch. A number of concrete slabs were made and tested, and the effect of such factors as mix proportions, water contents, time of troweling, dust-coat finishes, and liquid surface treatments determined.

Steel disks without the use of an added abrasive showed large differences in wear resistance near the surfaces of the slabs. This seemed to be related to the amount of water which appeared on the surface during placing and finishing. The wear with steel disks and added abrasive was useful in determining the resistance of the subsurface. For the same mix proportions, wear resistance was greatest for the highest cement-water ratios. For equal C/W

ratios, wear resistance increased with increasing proportion of coarse aggregate up to a certain point, then decreased.

The mixes tested, which varied from a 1:2 mortar to a 1:3:6 concrete, al showed more or less pitting after the smooth surface had been worn off. The leaner mortars generally showed the greatest amount of pitting. The highest wear resistance and least pitting were shown by the drier mixes, by mixes containing gravel, and by surfaces treated with dust coats containing cement, troweled into the fresh surface. Damp-curing or the use of a high early strength cement increased wear resistance.

By means of the same apparatus it was also possible to study the dusting of surfaces. Dusting was reduced by surface applications of solutions of magnesium fluosilicate or of water glass, where the mortar had not been damp-cured. The effect of such treatments appears to be confined to the top 0.01 inch of the slabs.

No significant reductions in wear were obtained by liquid surface treatments when applied to slabs damp cured for 6 days.

ABRASIVE RESISTANCE OF BRICKS

That sewage will cause an abrading action on the materials forming the bed of the sewer is well known. The severity of this action depends on the velocity of flow and on the content of abrasive, such as quartz sand, for example Recognition has been given in specifications for sewer brick to the fact that ability to resist abrasive action is one of the necessary properties of such bricks. Since specifications for sewer brick do not include direct measures of abrasive resistance but are based on the assumption that such properties as strength and absorption are so related to abrasive resistance that suitable requirements for these properties will insure suitable performance, it appeared desirable to check these relations.

Accordingly, the Kessler portable abrasion tester was used to determine the comparative abrasive resistance of approximately 50 shale, clay, and fire clay bricks of known strength and absorption. These bricks represent the maximum range in properties commercially available. The Kessler apparatus consists of a circular steel foot, 2⅛ in. in diameter, which supports a load of 8.8 lb. This foot bears upon the brick surface to be abraded, and rotates at a speed of 100 rpm. Sixty-mesh artificial corundum is fed through an opening in the center of the foot and discharges at the periphery. The test consists in weighing the specimen (a half brick) to the nearest 0.01 gram, abrading for 5 minutes, and reweighing.

The majority of these tests were made on dry bricks. A few tests were made under water on bricks previously saturated by boiling.

From these data on abrasive loss, compressive strength, and water absorption the following conclusions appear justified:

1. Abrasive loss increased as compressive strength decreased. Plotting compressive strength against abrasive loss gave points which fell in a band hyperbolic in form irrespective of whether bricks were wet or dry.

2. All bricks exceeding 11,000 lb/in.^{2} in compressive strength showed losses less than 2.0 grams in the abrasion test. The maximum abrasive loss for bricks exceeding 7,000 lb/in.^{2} in compressive strength was less than 4.0 grams. The maximum abrasive loss for all bricks exceeding 2,500 lb/in.^{2} in compressive strength was less than 10.0 grams. All bricks with compressive strength less than 2,000 lb/in.^{2} exceeded 18.0 grams in abrasive loss.

3. Abrasive loss increased as water absorption by 5-hr boiling increased. The relation is rather definite for bricks with absorption less than 12 percent. Above 12 percent absorption showed little relation to abrasive loss.

4. All bricks with absorption by 5-hr boiling less than 10 percent were associated with losses of less than 2.0 grams in the abrasion test. The maximum loss for bricks having absorptions less than 12.0 percent was less than 4.0 grams.

5. Where bricks have high absorptions associated with high compressive strength, abrasive loss is normal for the absorption rather than for the strength.

6. The correlation between abrasive loss and the properties of strength and absorption appears high enough to warrant specifying strength and absorption for the purpose of controlling resistance to abrasion.

A detailed report of this investigation will appear in a paper entitled, Effect of Water Absorption and Strength on Resistance of Bricks to Abrasion, by John W. McBurney, Russell H. Brink, and Allan R. Eberle.

STRUCTURAL PROPERTIES OF A BRICK CAVITY-WALL CONSTRUCTION

As part of the program on low-cost house construction, tests were recently completed on 12 wall specimens submitted by the Brick Manufacturers' Association of New York, Inc. These represented a brick cavity-wall construction sponsored by the association.

The specimens were subjected to compressive, transverse, concentrated, impact, and racking loads, simulating conditions in an actual building. The results, presented graphically and in a table, have been published as Building Materials and Structures Reports BMS23, copies of which are obtainable from the Superintendent of Documents Government Printing Office, Washington, D. C., at 10 cents each.

STRUCTURAL PROPERTIES OF REINFORCED-BRICK AND BRICK-TILE CAVITY WALL CONSTRUCTIONS

Nine specimens representing a reinforced-brick wall construction, and 18 specimens of brick-tile cavity-wall, submitted by the Structural Clay Products Institute, were tested a short time ago at the Bureau. The reinforced-brick wall specimens represented a construction designed to resist transverse loads while the brick-tile cavity-wall specimens were typical of a type of construction which has been used extensively in Europe and is now finding favor in this country.

The reinforced-brick wall specimens were subjected to compressive, transverse, concentrated, and impact loads The brick-tile cavity-wall specimens were subjected to the same, plus racking loads. The transverse, concentrated, and impact loads were applied to both faces of the brick-tile cavity-wall specimens, thus simulating the loads applied to the elements of a house.

For each of the loads three like specimens were tested. The deformation under load and the set after its removal were measured for uniform increments of load, except for concentrated loads, for which the set only was determined. The results, presented graphically and in tables, are now available in Building Materials and Structures Report BMS24, copies of which are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

DETERMINATION OF CROSS-SECTIONAL AREAS OF STRUCTURAL MEMBERS

In structural design increasing emphasis is being placed on the requirement of least weight for given strength. This is particularly true in the design of aircraft, in which excess structural weight reduces the useful load. In introducing new types of construction, involving in many cases new materials and new methods of fabrication, the designer is guided by the stresses obtained from laboratory tests of such structures. These stresses may be subject to an uncertainty of several percent if they are based on the nominal cross-sectional areas. For example, a thickness tolerance of ± 0.002 in. amounts to ± 5 percent for sheet metal 0.04 in. thick. An accurate value of cross-sectional area would reduce this uncertainty and make possible more efficient design.

The cross-sectional areas of many of the modern light-weight members cannot be obtained accurately from measurements of the cross sections, because of their size or shape. In such cases, the average area can be obtained by a volumetric method, that is, by dividing the volume of the member by the length. The volume can be obtained by dividing the weight of the member by the density of the material or by immersing it in a liquid. If the area varies from section to section, the area of a given cross section can sometimes be obtained from the average area of a short specimen taken from that location.

It is necessary to observe a number of precautions in order to obtain accurate values of cross-sectional area for such small specimens. James A. Miller has embodied these precautions in a detailed procedure (set forth in RP1258 in the November Journal of Research) for determining the cross-sectional area of a typical airship girder. The cross-sectional area varied because of a row of flanged circular lightening holes along each side, and was a minimum at the cross sections through the centers of the holes. Short specimens symmetrical to a minimum section were cut from each corner of the girder. The end surfaces were ground smooth and nominally parallel so that the length could be measured accurately. The volume was determined by hydrostatic

weighing. An expression was derived by which the minimum cross-sectional area of such specimens can be computed from their average area. The resulting value of minimum cross-sectional area for the illustrative example was estimated to be correct within ±0.4 percent.

METHODS FOR ESTIMATING THE CORROSIVITY OF SOILS

The Magnolia Pipe Line Co. measured the depths of the deepest three pits on each joint of a 25-mile pipe line, and also estimated the condition of each joint. The resistivity of the soil was measured with a Shepard resistivity meter at 200-foot intervals. A soil survey of this line was made and several samples of each type of soil were obtained.

The pH values, total acidity, and electrical resistivity at saturation and at moisture equivalent of the soil samples were measured. The corrosivity of the soil samples has been determined by methods which include those devised by Corfield, Denison, Legg, and Putnam and the results of these tests, as well as the corrosivity of the soil as indicated by its field resistivity, resistivity at moisture equivalent, and by its acidity, have been correlated with the depth of the deepest pit on the joints of pipe nearest the points where the samples of soil were obtained. The correlations are presented in the form of charts. They show that the result of a single test by any of the methods tried cannot be depended on to predict correctly the depth of the pit which may occur in the soil represented by the sample. However, if the data for all the samples from a soil series are averaged, the results of tests by any one of several methods will give a satisfactory indication of the average corrosivity of the soil series.

It has also been shown that there is a reasonably close relation between the depth of the deepest pit on a joint of pipe, the estimated condition of the pipe, and number of leaks.

BACKFLOW PREVENTION IN OVER-RIM WATER SUPPLIES

The danger of contamination of the water supply of buildings by the backflow of water from plumbing fixtures and drains, thereby menacing the health of persons using this water supply, has been receiving a great deal of attention from health authorities and officials in recent years. Numerous cases of disease, many of them causing death, have been traced to water that had been contaminated in this way.

It is not necessary that a direct pipe connection exist between the drainage and supply systems in order to bring about a dangerous condition. Toilet bowls with flush valves or tanks may be dangerous unless properly protected, since the occurrence of a vacuum in the supply line may produce a backflow of air from the toilet bowl, and the high velocity of this air flow may cause contaminated water to be carried from the bowl back into the supply line. Similarly, if a faucet opening is too near the water surface in a flooded lavatory, the occurrence of a vacuum in the supply line may draw water back through the faucet, if open or leaking, even though the faucet opening is not submerged.

In a paper entitled Cross-connections in Plumbing Systems, J. Research NBS 20, 479 (April 1938) RP1086, analyses were presented of the conditions under which backflow may occur in plumbing systems, as well as experimental data relating to these conditions. Building Materials and Structures Report BMS28, which has just been issued, is supplementary to RP1086 and contains the solution of a specific problem in this field—namely, the determination of the minimum requirements necessary to prevent backflow of the contents of an over-rim supply fixture, such as a lavatory, into the supply lines across a vertical air gap when a vacuum exists in the line.

This project, which was instituted by the Bureau, was carried to completion by the Plumbing Fixture Manufacturers' Research Association, which was sponsored by the Vitreous China Plumbing Fixtures' Association, the Sanitary Cast Iron Enameled Ware Association, the Sanitary Brass Institute, and the National Brass Association.

The report deals principally with the technical phases of preventing backflow of water from over-rim supply plumbing fixtures. It contains a discussion of past work on the subject, an analysis of the limiting values of the conditions that tend to cause backflow across air gaps, a determination of minimum requirements for the positive prevention of backflow through over-rim supply faucets under the extreme conditions that can occur, and suggested safety regulations, which are presented in simplified form.

Copies of BMS28 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

REFRIGERATION AND AIR-CONDITIONING REQUIREMENTS OF PRINTING PLANTS

Air conditioning is of great importance in the printing industry, because atmospheric variations and extremes of temperature or humidity result in troublesome operating problems. Paper used in printing is very sensitive to atmospheric conditions, as are some of the other materials and processes. The variations and extremes, therefore, interfere with production and in many instances result in spoilage and lowered quality of the finished products. Symptoms of disturbing atmospheric effects are: Static electricity; misregister of color prints; ink set-off; distorted wood block cut mounts; roller troubles; and distorted, curling, and buckling papers. An air-conditioning system of correct design, if properly operated, will provide satisfactory solution of the problems involved by removing the causes of the disturbing effects. However, the atmospheric requirements of some of the processes of printing are exacting and each kind of printing has its own peculiar problems.

The principal processes of printing that require special consideration are: Multicolor offset lithography; all other sheet-fed processes, including letterpress, sheet-fed gravure, wet-process color printing, and engraving; and newspaper and other web-fed printing. The conditioning requirements of each process and the degree of atmospheric control required for best results in each kind of plant are discussed in detail in an article by Charles G. Weber, of the Bureau's Paper Section, published as a part of the Refrigerating Data Book by the American Society of Refrigerating Engineers.

The control of relative humidity is most essential, but control of temperature is also important. Central-station plants for conditioning the air of the entire building or the area used for the print shop have proved most successful and the dew-point system of control with refrigeration for dehumidification is applicable to all printing plants. This method of conditioning combines heating, ventilating, dust removal, and air conditioning in one system, and provides the required conditions throughout the year.

INTERFEROMETER FOR MEASURING DIMENSIONAL CHANGES IN RUBBER

A method for measuring small dimensional changes by the use of an interferometer was developed by Fizeau and Abbé many years ago. Light of known wave length transverses an air gap between two quartz plates separated by the material being studied, and interference occurs between the beams reflected from the surfaces of the plates. Changes in the dimensions of the specimens cause corresponding changes in the air gap, and a displacement of the interference fringes occurs. In this manner it is possible to measure the displacement in terms of the wave length of the light employed.

The application of this method of measurement to soft rubber is described in a paper by Lawrence A. Wood, Norman Bekkedahl, and Chauncey G. Peters, which will be published in the November Journal of Research RP1253). The relatively easy deformation of the rubber gives rise to problems which do not occur in the application of the interference method to such rigid substances as metals, glass, and ceramic materials, to which it has been previously applied. The paper discusses the apparatus used and the technique employed in the measurement of dimensional changes in rubber and gives consideration to its limitations as well as to its advantages in comparison with other methods. As a means for determining the expansivity at different temperatures, particular emphasis is placed on measurements at temperatures as low as that of liquid air. These low-temperature measurements are also useful in determining the dimensional changes involved in transitions between different forms of rubber, and the temperatures at which these transitions occur.

The lower limit of temperature was set only by the refrigerating liquid. With unvulcanized rubber, excessive plastic flow made measurements impossible at temperatures above about 0° C; with vulcanized rubber, however, no upper temperature limit set by plastic flow was observed in a series of observations which extended as high as 100° C.

The method requires continuous observation, but as compared with alternative methods of measuring small dimensional changes it possesses advantages arising from its high sensitivity, the small size of the specimens required,

the ease of obtaining temperature equilibrium, the absence of a confining liquid, and the simplicity of the calculations.

TENSILE PROPERTIES OF RUBBER COMPOUNDS

In order to determine whether the tensile properties of a rubber compound measured at high stretching rates offer any better indication of resistance to abrasive wear than the properties measured at the usual testing rates, Frank L. Roth and William L. Holt developed a special apparatus for stretching ring specimens to rupture by means of a falling weight. Tensile properties of the ring specimens were determined from a study of the position of the weight as a function of time. The position of the weight was recorded at equal time intervals on a paper tape of which one end was fixed to the weight. The tape was pulled through a spark gap as the weight fell. The timing of the sparks was controlled by a tuning fork. Specimens were stretched to the point of rupture in about one-half to three-quarters of a second. The work of extension was determined as a function of the elongation of the specimen from the instantaneous positions and corresponding speeds of the weight. Stress-strain relationships were then obtained from the work of extension.

As described in the November Journal of Research (RP1256), tests were made on a range of cures of each of four rubber compounds. One of these was a pure-gum compound, and each of the other three contained 25 volumes of a filler per 100 volumes of crude rubber. The three fillers used were channel black, soft black, and clay.

A comparison of these data with similar data for a rate of stretch which lies in the range of speeds common to the usual routine tests fails to show that the tensile properties measured at the high stretching rates offer any better indication of resistance to abrasive wear than the properties measured at the usual testing rates.

PHOTOCHEMICAL DECOMPOSITION OF THE CYSTINE IN WOOL

Many substances, such as proteins, carbohydrates, and fats, deteriorate during exposure to light. The destruction of the epidermis of the skin by sunlight, commonly referred to as sunburn, is a typical example. Wool is similarly damaged by intense light. On prolonged exposure, the damage is immediately obvious. The fiber becomes yellow and brittle, and exhibits a considerable loss in tensile strength and resiliency. Small amounts of damage may not be so obvious but may be accentuated during subsequent processing of the fiber. Tips of fibers are often damaged by sunlight while the wool is still on the sheep. Wool so damaged is referred to as "tippy" wool by wool processors.

In the Journal of Research for November (RP1255) Henry A. Rutherford and Milton Harris report on a continuation of their researches relating to the nature of this breakdown. It was found that the primary action of the light results in the breaking of the chemical bond between the sulfur atoms of the disulfide groups. The extent of the breakdown is independent of the amount of moisture in the system. However, a secondary process occurs, in which it appears that water reacts with one of the decomposition products of the primary reaction and liberates hydrogen sulfide. It is also shown that the amount of destruction produced by the heat under the conditions of these experiments is very small, and that the damage to the fibers results almost entirely from photochemical effects.

INTERNAL ABSORPTION OF GAMMA RAYS IN RADIUM-BERYLLIUM NEUTRON SOURCES

The amount of radium in commercial preparations is determined by comparison of the strength of the gamma rays from such a preparation with the strength of the gamma rays from a known radium standard. For all radium preparations compared in this way the question of the amount of absorption of the gamma rays in the radium salt itself must be considered. Fortunately in most instances the commercial preparation and the radium standard are nearly the same size and the internal absorption is almost the same in each and can be neglected.

Recently a new type of radium preparation, consisting of a mixture of a radium salt with powdered metallic beryllium and intended to be used as sources of neutrons, has appeared on the market. The amount of beryllium is several times the amount of the radium, and the internal absorption in such a preparation is much greater than in a concentrated radium standard. In order to determine the amount of ra-

dium in such preparations by gamma comparisons, it is necessary to know the amount of the correction to be made because of the differences in internal absorption in the radium standard and the neutron source.

Leon F. Curtiss has determined this correction experimentally for one particular source of the usual type by measuring the radium before mixing it with beryllium to prepare a neutron source and again determining the apparent amount in the neutron source, after preparation, by a gamma-ray comparison with a radium standard. The correction was found to be 5.1 percent, which means that the actual amount of radium in a neutron source of this type is 5.1 percent greater than the apparent content as given by the usual gamma-ray measurement.

The complete description of these measurements will be published as RP1257 in the Journal of Research for November.

COSMIC-RAY OBSERVATIONS IN THE STRATOSPHERE

A paper by Leon F. Curtiss, Allen V. Astin, Leroy L. Stockman, and Burrell W. Brown in the November Journal of Research (RP1254) describes an investigation of cosmic-ray strength in the stratosphere by means of free balloons carrying a radio transmitter to send the measurements to earth, where they were picked up by a special receiving station. This was accomplished by using a sensitive tube circuit to detect the cosmic rays. A special vacuum-tube circuit connected to the counter caused the radio transmitter to send out a signal for every 60 cosmic rays detected by the counter. This permitted the use of a large sensitive counter which counted cosmic rays at the rate of 2,000 to 3,000 per minute. In this way variations in the cosmic-ray intensity, as a result of their random distribution in time, were leveled out and a more accurate estimate of their intensity could be obtained.

A barometer attached to the equipment gave measurements of the atmospheric pressure, simultaneously with the cosmic-ray signals, to determine the altitude.

At an altitude of 64,500 feet it was found that the cosmic rays had a maximum intensity. Above this altitude they become less intense. The maximum was found to be about 200 times the intensity at the ground level. Observations were made up to 100,000 feet. A total of 15 ascents were made.

TROUBLE WITH MAGNETIC DAMPING OF BALANCES

Two balances with magnetic damping were found to give irregular errors caused by lack of proportionality between the excess load on one pan and the angle of deflection of the beam. In one of these balances the cause of this irregularity was studied, and was found to be the presence of a small speck of magnetic material firmly attached to one of the aluminum damping vanes.

The possibilities of such errors were noted a few years ago (Technical News Bulletin 189; January 1933), but the errors found at the present time were so narrowly localized that they would be overlooked unless deflections of the beam were tested with relatively small load increments. Minor errors not chargeable to any other known cause were found over nearly one-third of the usable deflection of the beam, but a distinctly larger error was located within about one-tenth of this range.

Since one of the great advantages of damping is the added convenience in using deflections of the beam instead of strictly zero methods, it is obvious that such balances, and especially those with magnetic damping, should be very carefully tested for proportionality of deflection to added load.

ASSIGNMENT OF UNCERTAINTIES TO THE DATA OF CHEMISTRY AND PHYSICS, WITH SPECIFIC RECOMMENDATIONS FOR THERMOCHEMISTRY

In order that the results of measurements made in different laboratories may be compared and appraised for the purpose of estimating the uncertainty or confidence interval to be attached to the published value of a physical or chemical constant, it is desirable that experimenters adopt a uniform procedure for expressing the consistency of their data. Understanding among workers in different laboratories will be promoted if all the investigators in any field will be careful to give the information that is essential for evaluating the consistencies of their final values. Some discussion on this subject, together with specific recommendations in connection with the experi-

mental data of thermochemistry, appears in a paper entitled The Assignment of Uncertainties to the Data of Chemistry and Physics, With Specific Recommendations for Thermochemistry, by Frederick D. Rossini of this Bureau and W. Edwards Deming of the U. S Department of Agriculture, which was published in the October 15, 1939, number of the Journal of the Washington Academy of Sciences. The contents of the paper are as follows: I, Introduction; II, Some notes on the theory of probability, including (1) the single sample or set of observations, (2) a pair of samples or sets of observations, (3) functional concordance; III, Propagation and combination of errors; IV, Application to measurements in general; V, Specific recommendations for thermochemistry, including (1) general remarks, (2) procedure for combining standard deviations, (3) discussion of the procedure, (4) the uncertainty interval.

SIMPLIFICATION OF GRADES OF HICKORY HANDLES

Simplified Practice Recommendation R77–39, Hickory Handles, the first revision of R77, became effective October 15, 1939.

This revision provides one set of grades for both long and short handles reducing the number of grades from 11 to 8. There are four primary classes, each of which is subdivided into two grades, one for white and the other for red or red and white handles. White handles in the two lowest quality classes permit some red wood on the ends Definitions for defects and blemishes and weight ranges in pounds per cubic foot for each grade classification have also been included.

This recommendation represents the results of the industry's efforts to conserve hickory by reducing the number of handle grades and by emphasizing quality and utility rather than appearance in the selection of handles. It was originally promulgated in 1927 and reaffirmed by the standing committee in 1930 and 1935.

The revised printed issue will include a brief history of the development of the project and will list the members of the standing committee and acceptors of the recommendation. Until the printed copies are available, free mimeographed copies can be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

SIMPLIFICATION OF SIZES OF PAPER CONES AND TUBES

Simplified Practice Recommendation R143–39, effective from October 15, 1939, is the first revision of the recommendation covering paper cones and tubes. This simplified schedule gives the stock sizes of cones and tubes used for winding warp and knitting yarns of silk, rayon, cotton, and worsted; hosiery yarns; asbestos roving; tire cords; thread; wire insulating yarns, etc.

In its original form, this program became effective in 1933, and was reaffirmed by the standing committee in 1934 and 1935, after a cone for asbestos roving had been added.

The current revision, affecting only paper cones, provides for the elimination of two cones no longer in use and the addition of three cones of the 3°30′ type which have come into general use for winding silk and rayon yarns.

In addition to the schedule of sizes of cones and tubes, the revised printed edition will include a brief history of the project, and will list the present members of the standing committee and acceptors of the recommendation. Until this edition is ready, free mimeographed copies of the revision are obtainable without charge from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

NEW AND REVISED PUBLICATIONS ISSUED DURING OCTOBER 1939

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 23, number 4, October 1939 (RP1245 to RP1251, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers [2]

[Reprints from the July 1939 Journal of Research]

RP1218. X-ray diffraction patterns of Hevea, Manihot, and other rubbers. George L. Clark, Siegfried T. Gross, and W. Harold Smith. Price 5 cents.

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[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

RP1219. Properties of air-setting refractory-bonding mortars of the wet type. Raymond A. Heindl and William L. Pendergast. Price 10 cents.

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RP1229. Thermal properties of saturated water and steam. Nathan S Osborne, Harold F. Stimson, and Defoe C. Ginnings. Price 5 cents.

Building Materials and Structures [2]

[Persons who wish to be notified of new publications in the "Building Materials and Structures" series as soon as they are available should write to the Superintendent of Documents, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

During the past month the following publications in this series have been issued:

BMS20. Structural properties of "Twachtman" constructions for walls and floors sponsored by Connecticut Pre-Cast Buildings Corporation Herbert L. Whittemore, Ambrose H Stang, and Douglas E. Parsons. Price 10 cents.

BMS23. Structural properties of a brick cavity-wall construction sponsored by the Brick Manufacturers Association of New York, Inc. Herbert L. Whittemore, Ambrose H. Stang, and Douglas E. Parsons. Price 10 cents.

BMS24. Structural properties of a reinforced-brick wall construction and a brick-tile cavity-wall construction sponsored by the Structural Clay Products Institute. Herbert L. Whittemore, Ambrose H. Stang, and Cyrus C. Fishburn. Price 10 cents.

BMS28. Backflow prevention in overrim water supplies. Gene E. Golden and Roy B. Hunter. Price 10 cents.

Simplified Practice Recommendations [2]

R163-39. Coarse aggregates (crushed stone, gravel, and slag). (Supersedes R163-36.) Price 5 cents.

Commercial Standards [2]

CS14-39. Boys' button-on waists, shirts, junior and polo shirts (made from woven fabrics). (Supersedes CS14-31.) Price 5 cents.

Technical News Bulletin [2]

Technical News Bulletin 270, October 1939. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

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LC566. Electrodeposition: Publications by the staff of the National Bureau of Standards. (Supersedes LC121.)

LC570. Standards and specifications for building and construction materials, fixtures, supplies, and equipment. (Supersedes LC323.)

RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [3]

The national standards of measurement. Lyman J. Briggs. Ind. Standardization and Commercial Standards Mo. (29 West 39th St., New York, N. Y.) 10, 227 (September 1939).

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrador), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government unless otherwise stated. Requests should be sent direct to the publishers.

A review of the U. S. Bureau of Standards' work during 1939 on underground corrosion. K. H. Logan. Oil and Gas J. (Tulsa, Okla.) **38**, 112 (Sept. 21, 1939).

The precision of knock rating—1936-38. D. B. Brooks and R. B. Cleaton. S. A. E. J. (Society of Automotive Engineers, 29 West 39th St., New York, N. Y.) **45**, 449 (October 1939).

Sealing platinum to Pyrex glass. Edward Wichers and C. P. Saylor. Rev. Scientific Instruments (Cornell University, Ithaca, N. Y.) **10**, 245 (September 1939).

The significance of tests. Warren E. Emley and L. B. Tuckerman. Bul. Am. Soc. Testing Materials (200 South Broad St., Philadelphia, Pa.) **11** (August 1939).

An instrument for estimating tautness of doped fabrics on aircraft. G. M. Kline and H. F. Schiefer. Natl. Advisory Com. for Aeronautics Tech. Note 729 (Obtainable from National Advisory Committee for Aeronautics, Washington, D. C.) (September 1939).

Tensile elastic properties of 18:8 chromium-nickel steel as affected by plastic deformation. D. J. McAdam and R. W. Mebs. Natl. Advisory Com. Aero. Report No. 670. (Obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C., at 15 cents a copy). (September 1939).

Proposed sizes of cans for fruits and vegetables. W. E. Braithwaite. The Canner (140 North Dearborn St., Chicago, Ill.) **89**, 11 (Sept. 30, 1939).

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